

Strong donor–strong acceptor approach to realize a single band low bandgap copolymer toward red–selective thin film organic photodiode

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Recently, organic photodiodes (OPDs), using organic semiconductors as photoactive layers with a high extinction coefficient and tunable absorption spectrum, have attracted much attention as possible alternatives of Si photodiodes.

There have been numerous number of new semiconductors that have successfully resulted in fabrication of green and blue–selective OPDs, but for red–selective OPDs, successful demonstrations have been limited due to difficulties in realizing genuine red–selective absorption feature from organic semiconductors. Herein, a new kind of thiophene–linked donor–acceptor copolymers with phenanthro[1,10,9,8–cdefg]carbazole (PCZ) as donor unit and diketopyrrolopyrrole as acceptor unit were synthesized (PCZ–Th–DPP). A planar nature of both PCZ and DPP unit as well as their strong electron rich and deficient characteristics, respectively, enabled excellent red selective absorption feature. In addition, high absorption coefficients enable highly efficient charge separation within the depletion width of the Schottky OPD resulting in high photodetectivity.